



Maximizing Utilization of Light Tight Oils Economics and Technology solutions

Mel Larson, Principal Consultant





Melvin G. Larson
Principal Consultant

Profile

- Principal Consultant at KBC with over 31 years experience as a Chemical Engineer.
- Responsibilities include but are not limited to specialty consulting in FCC, serving as Project Manager on various KBC projects, and as Manager / Principal Advisor on 150 KBPD grassroots refinery build.
- Consulting services specialize in process troubleshooting and profit improvement analysis in the FCC, Unsaturation Gas Plant, Alkylation and Naphtha Reformer areas.
- 10+ years refinery hands-on experience with unique awareness to day-to-day operations / troubleshooting.

KBC Experience

- Technical Advisor to National Oil Company's new Latin American refinery project. FEL-0 through FEL III assistance in complete complex and build both strategic and in detailed work assistance with owner, licensors and EPC firm.
- Served as project manager on Profit Improvement Programs with extensive international experience, working in USA, Europe, Australia, South America, South Korea and Japan.
- Worked as key advisor on a grassroots complex refinery build. Personal responsibilities required overall refinery knowledge and capability to manage and coordinate multiple disciplines on both client and company aspects of the work.
- Assisted majors in various troubleshoot operations on FCC, including excessive catalyst losses, the re-optimization of operation for higher conversion with existing equipment.
- Identified and implemented charge rate increase in USGC FCC by 3 kbpd without investment and over 20% additional capacity in Japanese FCC Unit without investment.
- Coordinated FCC and Unsaturation Gas Plant analysis on major Yield and Energy Surveys throughout the world. The unsaturation gas plant analysis often includes rigorous simulation of the facilities.

Education

- B.S. in Chemical Engineering from Rose-Hulman Institute of Technology.

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- The US will produce over 9 MM Bbls/Day on average of crude oil in 2015. North America (including Mexico) now has identified reserves of over 280 trillion barrels.
- US shale crudes in many cases are triple plays meaning there is a harvesting of natural gas (NG), natural gas liquids (NGLs) and light sweet crudes with low bottoms contend.
- If the US legislature reverses course and allows export of crude oil then a new era has just started.
- The presentation will touch upon the economics of North American crudes, the known challenges of processing these crudes along with innovative concepts that allow the refinery to maximize profit within the regional supply.



Crude Oil Movement Yesterday and Tomorrow

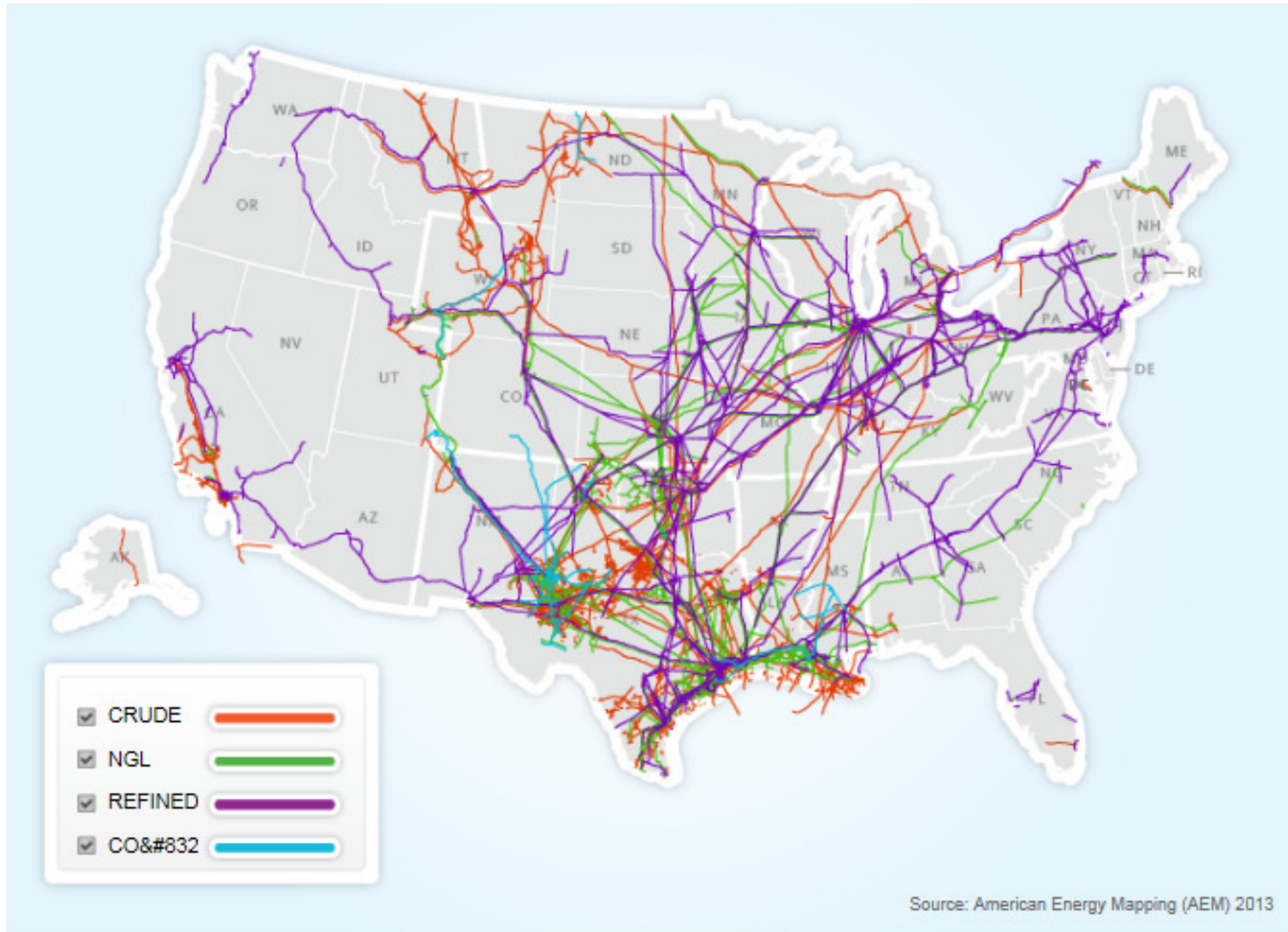
- The status quo of the last 40 years has changed
 - Crude prices at 100\$/bbl incentivized unconventional crude production
 - Canadian Oil Sands (DilBits)
 - Shale oils (Light and Tight)
- Foreign Government budgets tied to price and sales of crude
 - OPEC countries always pushing the allocated production
 - Nigeria, Venezuela, Iran, Iraq, etc all exported more than the stated allowance
 - Russian economy tied to sales of crude
 - More is better until.....

- Innovation – Harvesting oil in a competitive market
 - USA increased total crude oil production to 9 MM bbl/d
 - Pushed out like for like, i.e. light sweet crudes
- Domino effect – Politics
 - Lower US imports pushes African crudes to Asia at a discount to Saudi Arabia and other Middle Eastern suppliers
 - As price lowers below budgetary “breakeven” price, increased production necessary to hold revenue
 - Chinese demand growth slowing
- Market share critical for major players
- ***Net Result – More crude in the market than is being consumed – Lower price***

- We cannot stop as consumption will continue therefore
 - Drilling in conventional plays continues
 - Gulf Coast – US, Mexico, Colombia etc
 - Saudi Arabia completed 214 wells last year alone
 - ◆ Reported cost of 10-15\$/bbl
 - Unconventional Oil will continue at a slower pace
 - USA – Triple plays first then NGL/NG
 - Canadian oil required for Government budget
 - USGC exploration continues
 - Argentina continues to find and produce Shale
 - Exploration in low risk, high return regions before more politically unstable and risky locations.

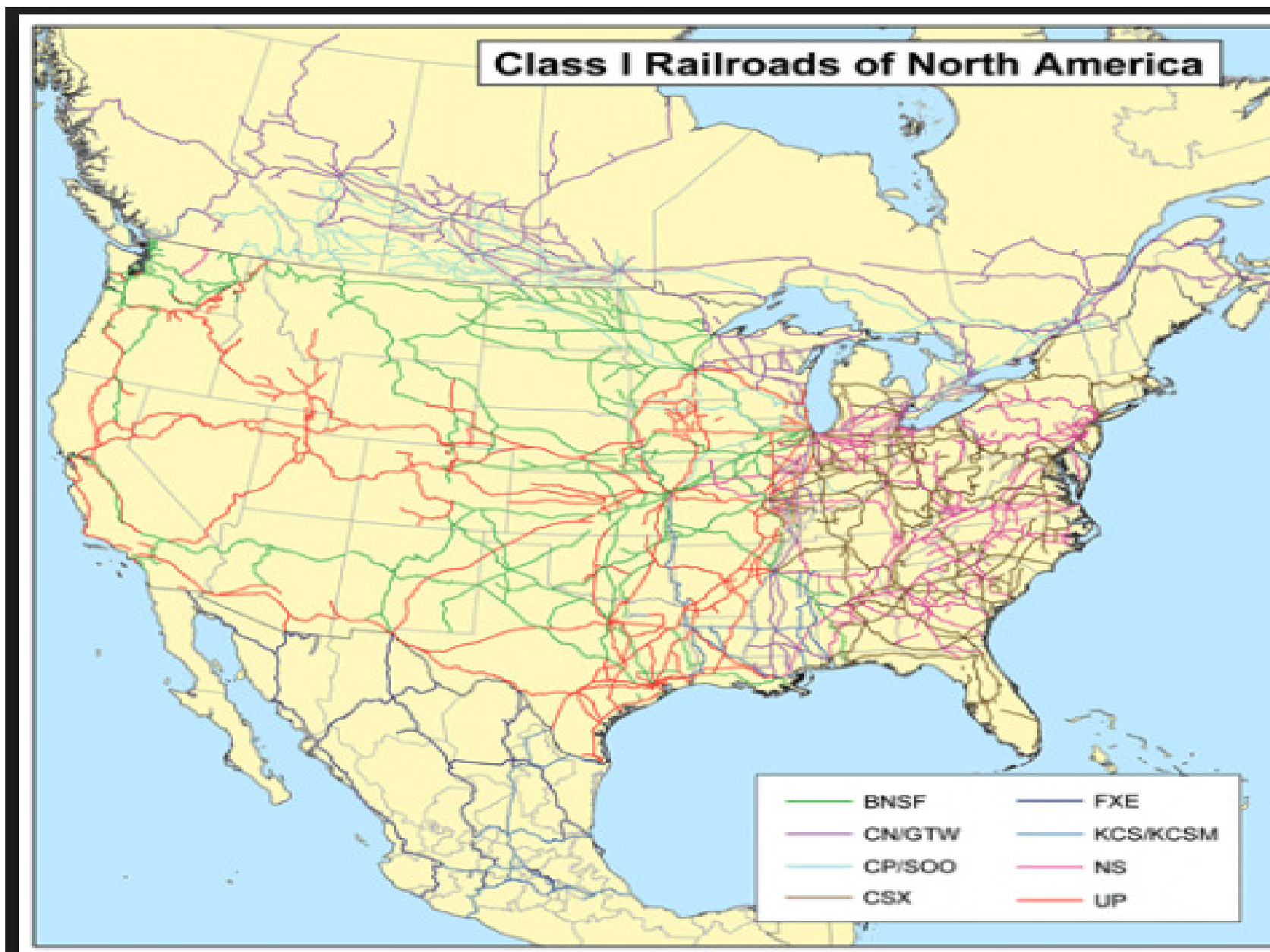
- Historical Basis
 - Incremental Oil processed in USGC and moved products inland North and East
- Change
 - Increase of Domestic Crude and Canadian DilBit now moves crude to USGC (pipeline reversal)
 - USA is blessed with infrastructure
 - USA free enterprise continues to update/ adjust to maximize oil opportunities
 - New pipelines / reversing flows
 - Rail system – pipeline on wheels
 - ◆ New Safety regulations will spur pipeline building
 - Potential isolate Regions in crude processing
 - Capline from Gulf to Patoka maybe be reversed !

USA – Pipelines

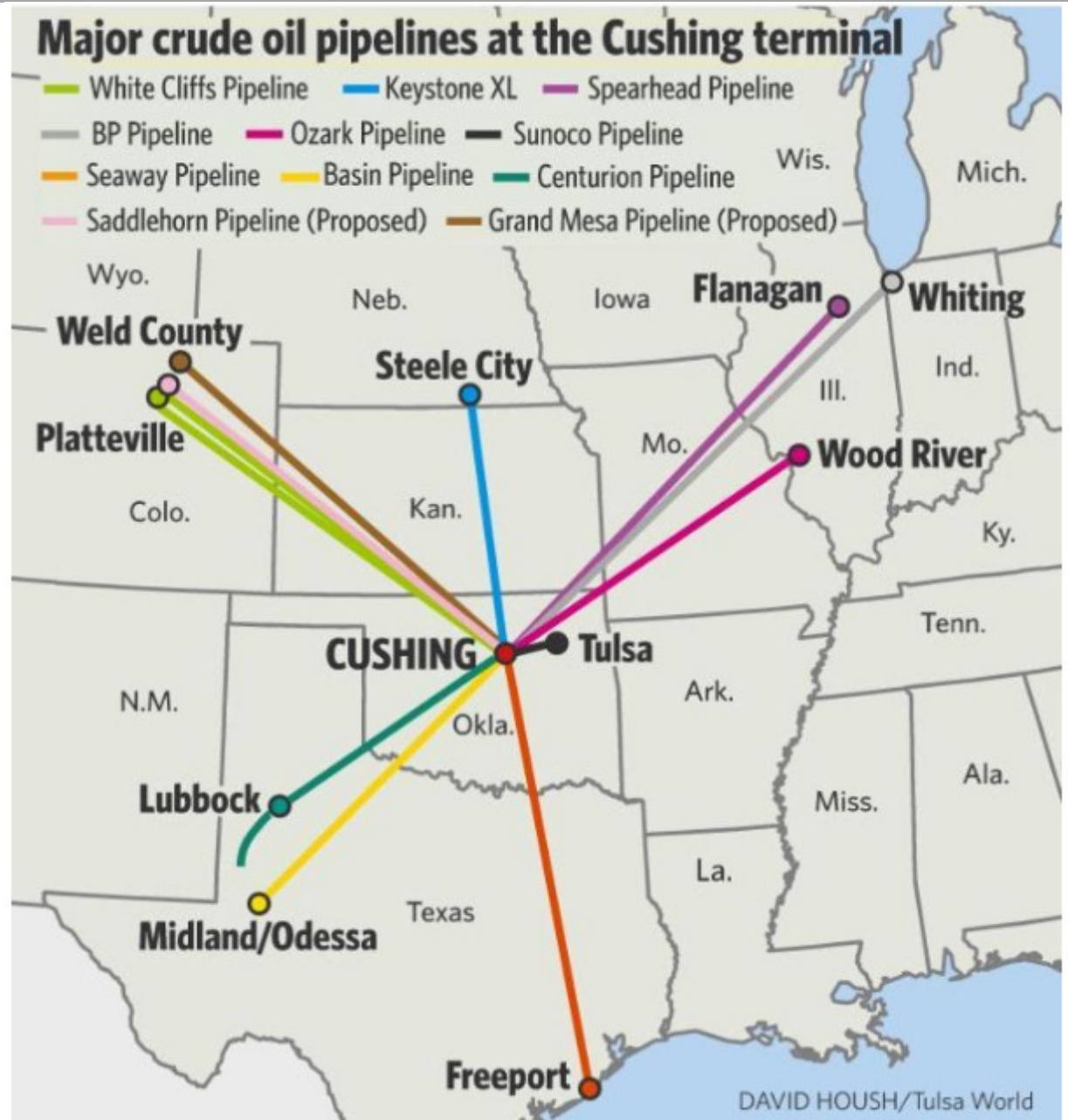


Source: American Energy Mapping (AEM) 2013

USA – Crude by Rail



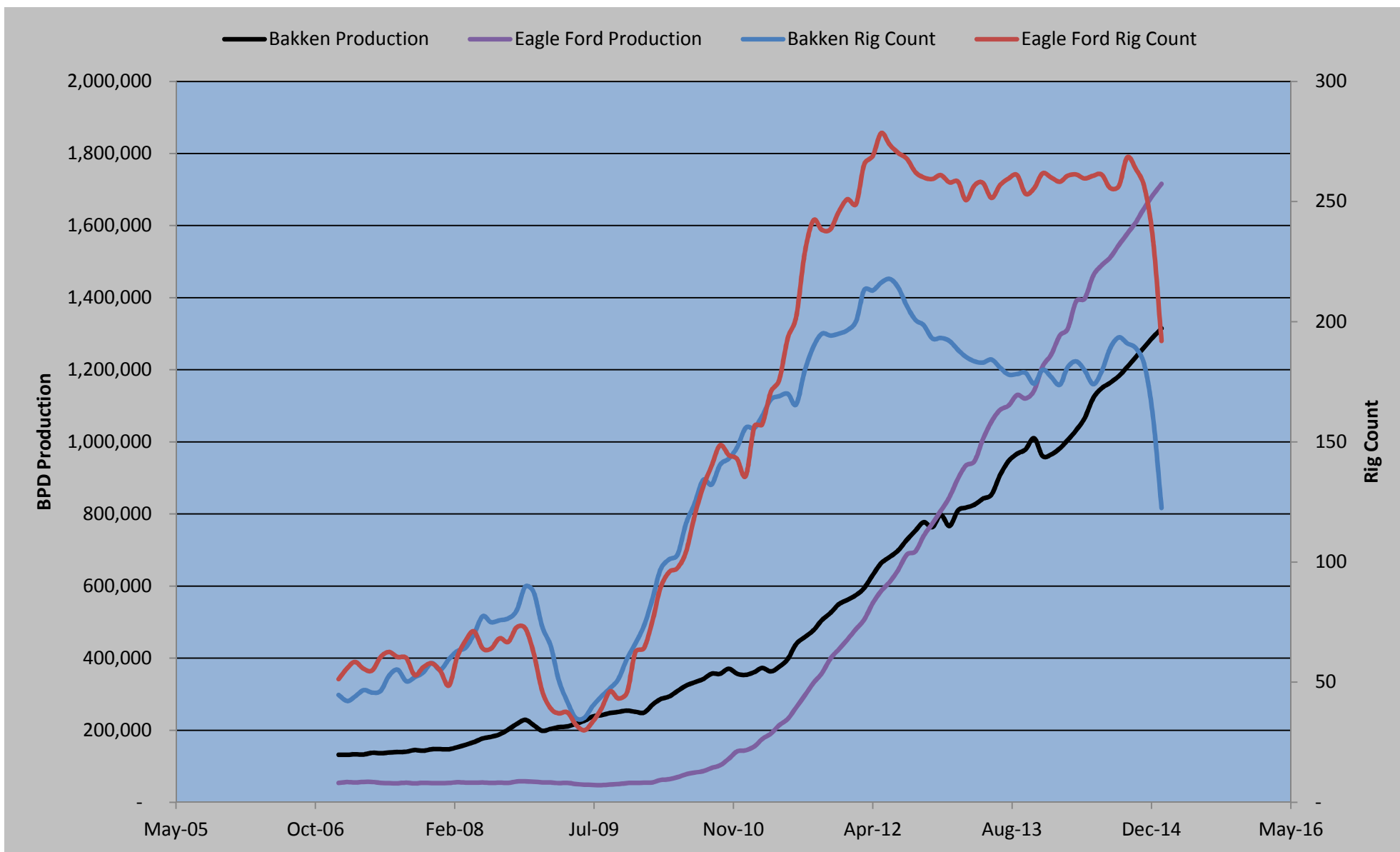
Cushing – Crude Moving to Gulf



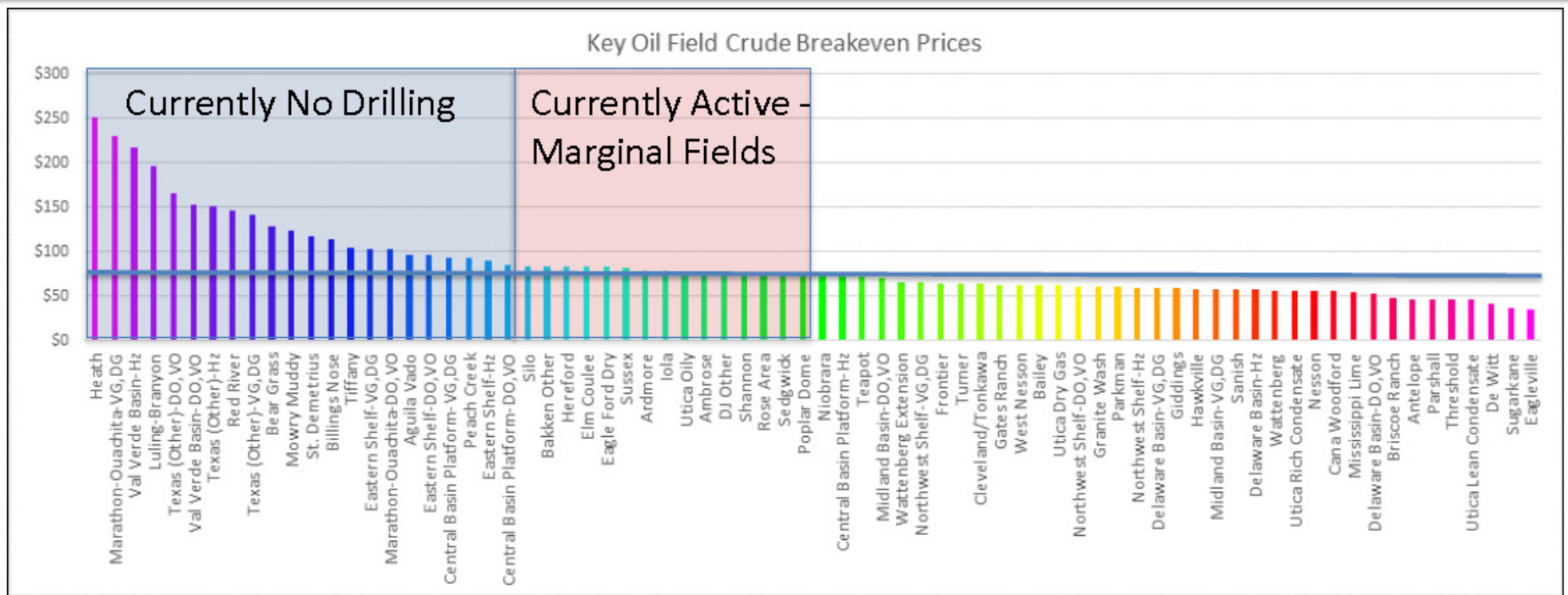
- LTO – Do not look at Rig Count
 - New innovations in LTO recovery will continue
 - Multi lateral legs have increased well production from 100 bpd to 300 bpd without a new hole
 - Consider triple play fields that increase the incentive for production
 - Land leases require drilling so that lease rights are not lost

- Agree that North American will have a variety of
 - Canadian DilBit
 - WTI or equivalent
 - LTO for the coming years

Production vs Rig Count



Estimated LTO production cost



- The order of this stack changes with:
 - Natural gas price changes
 - NGL price changes
 - Drilling efficiencies and technological advances

- LTO Pricing
 - Bakken at a discount to WTI of 10-15\$/bbl from lack of transportation
 - Eagle Ford / Permian priced on LLS thus a premium over WTI
 - Close to major refinery infrastructure in USGC
 - As crude by law has to be processed in USA i.e. cannot be exported without waiver or agreement (Canada processing Bakken)
 - US has pushed out nearly 100% of light crude
- Western Canadian Sour Discounted
 - Typical Differential is 15-20 \$/bbl under WTI

Economics – Cracked Spread



East Coast 6-3-2-1 (Brent + Freight)

Average:

1Q14	\$8.39
2Q14	\$7.46
3Q14	\$8.75
4Q14	\$9.31

QTD 15 \$10.38

Chicago 2-1-1 (WTI)

Average:

1Q14	\$21.18
2Q14	\$22.08
3Q14	\$20.55
4Q14	\$19.93

QTD 15 \$17.82

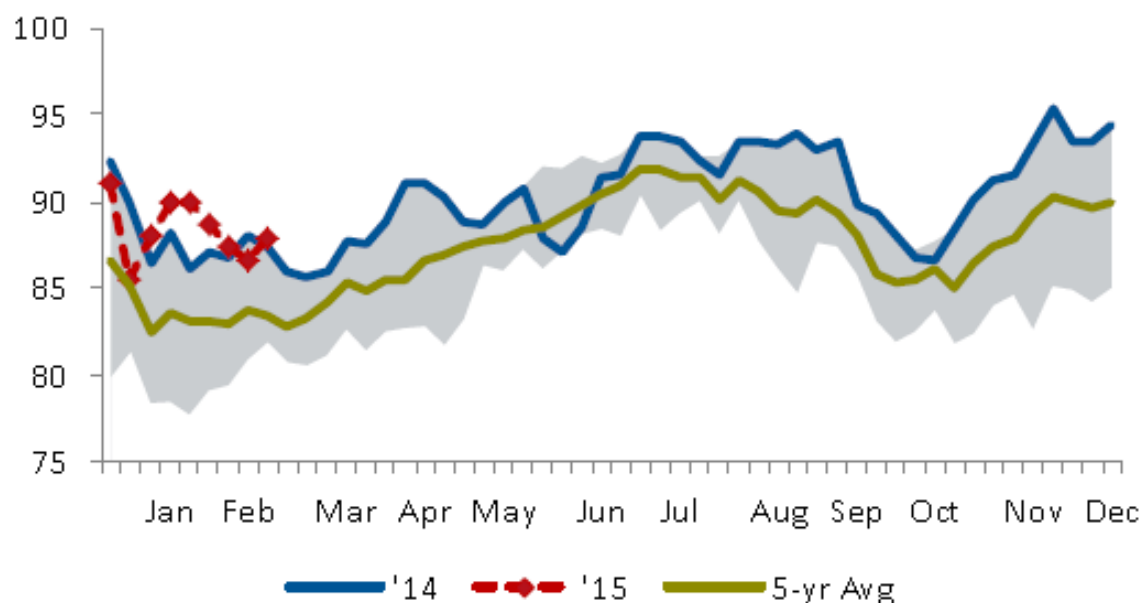
Gulf Coast 3-2-1 (LLS)

Average:

1Q14	\$10.86
2Q14	\$14.05
3Q14	\$12.11
4Q14	\$6.19

QTD 15 \$12.94

US Total Refinery Utilization (%)



- Cracked spread a function of crude cost, with domestic and foreign market.
 - Result high US Refinery Utilization



The US Advantage Everyone is a Merchant Refiner

- The USA has invested in heavy sour crude upgrading
 - Three recent big projects where
 - BP Whiting Expansion
 - Motiva Port Arthur Expansion
 - Marathon Garyville Expansion
 - Above expansions were with heavy sour Canadian crude in the crude blend
- Impact of LTO
 - Increase of naphtha / middle distillate improve the capability to meeting domestic demand
 - Export markets are lucrative thus refinery margin is high using North American (discounted) crude sources

- Keeping Crude in USA
 - 1978 Law forbids export of whole crude
 - Exceptions are limited (Canada)
 - Derivatives can be exported on self reporting basis (at will)
 - Thus companies like Enterprise, Pioneer, BPH, etc. can fractionate to export or produce to sell in USA.
 - If US allows export speculative on global impact
- Technology is improving to recovery oil below benchmark of \$50/bbl

“Canadian energy company [Encana](#) reports that new technology is allowing it to turn a profit in the Eagle Ford shale despite crude oil prices dipping below \$50 per barrel.”

US refiners well positioned

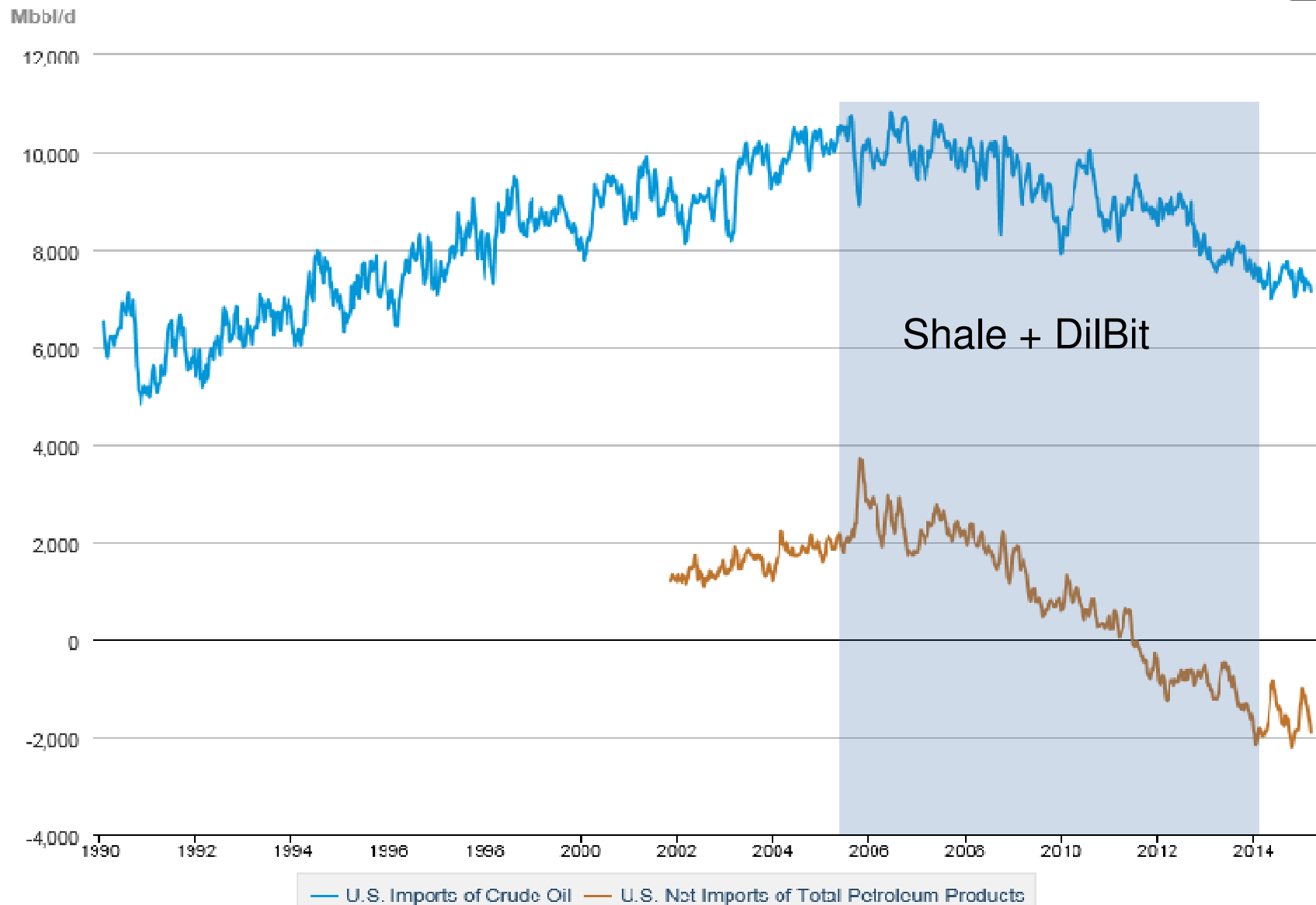


- LATAM markets will continue to be short finished Diesel and Gasoline for the next 10 plus years.
- Incremental crude at any refinery now pushes barrels product off shore. (exception is West Coast US)
 - USGC finished product inland is not unnecessary as Midwest supply can be satisfied with regional production
- Cheap / reliable crude from Canada through the US to Mexico (all of the Gulf Coast potentials) with the built assets give the US an enviable position in the market place.

US is net Exporter with Less Import Crude



Weekly Imports & Exports



Source: U.S. Energy Information Administration

- The view is crude has a new range between 60-70\$/bbl in the coming years
 - Crude price is subject to continued innovation and extraction of unconventional crudes and other countries production
 - Country budget needs will spur selected exploration into the least risk high return areas.
 - The glut continues
 - Asian growth pace will play a role
 - *New Panama Canal will dramatically change shipping and competition for customers between the US and MEA region*
- In the US economics will favor discounted crude sources that can be upgraded into high value markets
 - Domestic and foreign (Brazil, Argentina, Chile, Peru, etc.)

- FCC (after desalting of course)
 - The light stock volatile components increase C/O thus there is a potential to add more carbon via
 - Slurry or HCO Recycle
 - Alternative to compatibility issues

- ATRES from CDU to Coker (net or mixed)
 - Maintain coker capacity while potentially increasing incremental crude operation

- Process “topped” condensate from companies like Enterprise, Pioneer, etc. that is mostly middle distillate with a bit of bottoms, direct to FCC feed
- Process LTO into pumparounds of select towers
 - Check preheat system
 - Avoid crude compatibility issues

- EPA regulation changes are moving refinery investments to
 - FCC Scrubbers and or Hydrotreating all of the FCC feed
 - Coker operations to be tighten up to reduce steam vent
 - Emissions on Flares lowered
 - Unplanned emergency shutdowns a part of the overall environmental permit



Thank you

Questions?